

# Introduction

## OBJECTIVES OF THE STUDY

During the early 1990s, researchers at the International Maize and Wheat Improvement Center (CIMMYT) conducted a major study documenting the global impacts of international maize breeding research. The results of that study, published in 1994 in a CIMMYT monograph entitled *Impacts of International Maize Breeding Research in the Developing World, 1966-1990*, provided a wealth of information about the germplasm outputs of maize breeding efforts in developing countries and sketched out a compelling picture of the widespread diffusion of improved maize varieties and hybrids (López-Pereira and Morris 1994). In subsequent years, the data generated by CIMMYT's global maize impacts study came to be recognized as definitive and were widely used for a broad range of research investment and research management activities.

Following the completion of the initial study in 1994, CIMMYT made a commitment to update and extend its global maize impacts database roughly every five years. Regular updating was considered important given the extremely rapid rate of technological change that characterizes the global maize economy. Extending the database was considered necessary given the lack of success achieved during the initial study at collecting detailed and comprehensive information from the private sector.

Efforts to update and extend the maize impacts database were initiated in 1997. Given the great scope of the data collection task, the global study was divided into three regional studies—one each for Latin America, Sub-Saharan Africa, and Asia. This report presents the results of the first of the three regional studies, whose basic objectives remain largely unchanged from the initial global maize impacts study:

- to estimate the level of public- and private-sector investment in maize breeding research in developing countries;
- to document the germplasm outputs of public and private maize breeding programs in developing countries;
- to document the use of CIMMYT materials by public and private maize breeding programs in developing countries; and
- to estimate the rate of farm-level adoption of improved maize germplasm in developing countries.

An additional objective of the current studies—made possible by the availability of the baseline data collected in 1992—is to assess the nature and extent of the changes taking place in the organization and performance of the global maize seed industry.

## SOURCES OF INFORMATION

In addition to drawing on the original impacts data collected in 1992, this report presents new information collected in 1997 through an extensive survey of Latin American maize seed organizations. The survey covered 18 countries, including all of the region's leading maize producers (Table 1).<sup>1</sup>

Compared to the 1992 survey, the 1997 survey collected far more data from the private sector. Detailed questionnaires were completed by the

**Table 1. Coverage of the 1997 Latin America maize impacts survey**

	Public organizations surveyed	Private companies surveyed	Maize seed sales, 1996 (000 t)	Percent of formal maize seed market
<b>Central America</b>	<b>7</b>	<b>39</b>	<b>5.4</b>	<b>90</b>
Costa Rica	1	4	0.1	100
El Salvador	1	6	2.1	91
Guatemala	1	5	1.5	86
Honduras	2	13	1.0	95
Nicaragua	1	9	0.5	95
Panama	1	2	0.3	90
<b>Caribbean</b>	<b>3</b>	<b>4</b>	<b>2.4</b>	<b>95</b>
Cuba	1	0	1.6	100
Dominican Republic	1	2	0.5	100
Haiti	1	2	0.3	65
<b>Mexico</b>	<b>11</b>	<b>18</b>	<b>32.6</b>	<b>97</b>
<b>Central America, Caribbean, and Mexico</b>	<b>21</b>	<b>61</b>	<b>40.5</b>	<b>96</b>
<b>Andean Zone</b>	<b>11</b>	<b>63</b>	<b>21.1</b>	<b>96</b>
Bolivia	5	15	2.6	88
Colombia	1	9	3.2	95
Ecuador	2	7	2.8	96
Peru	2	15	1.6	88
Venezuela	1	17	10.9	100
<b>Southern Cone</b>	<b>4</b>	<b>48</b>	<b>219.4</b>	<b>98</b>
Argentina	1	14	64.9	94
Brazil	1	24	151.8	99
Chile	—	—	—	—
Paraguay	2	10	2.7	93
Uruguay	—	—	—	—
<b>South America</b>	<b>15</b>	<b>111</b>	<b>240.6</b>	<b>98</b>
<b>Latin America</b>	<b>36</b>	<b>172</b>	<b>281.0</b>	<b>97</b>

Source: Calculated by the authors.

directors of 36 public maize seed organizations (breeding programs and seed production agencies), as well as by representatives of 172 private companies. Virtually all of these respondents were personally interviewed; only in rare cases was the information collected indirectly (e.g., by mail or by relying on secondary sources). The sample included almost all of the public and private organizations in Latin America that currently engage in maize breeding; collectively, these organizations produced about 97% of the commercial maize seed sold in Latin America in 1996. Given the size of the sample, the information presented in this report provides an extremely comprehensive and highly accurate picture of the impacts of maize research in Latin America.

## DEFINITIONS OF KEY TERMS

Before proceeding, it is necessary to clarify a number of key terms. By convention, the products of scientific maize breeding programs, whether open-pollinated varieties (OPVs) or hybrids, are referred to as *improved materials*, reflecting the fact that their characteristics have systematically been altered in ways that bring economic benefits to those who grow them. Although use of the term *improved* is appropriate in this context, an unfortunate consequence of the convention is that the traditional varieties grown by farmers (referred to interchangeably in this report as *landraces* or *local varieties*) often end up being considered *unimproved*. This is clearly incorrect. Landraces have been subjected to numerous cycles of improvement at the hands of farmers, many of whom are skilled at identifying superior germplasm and expert at selecting individual plants that embody desired traits. Farmers' selection procedures in many ways resemble the selection procedures used in formal

<sup>1</sup> Chile, which features around 100,000 ha of maize area, was not included in the survey. The omission is relatively unimportant, however, because maize in Chile is grown in temperate environments that are not targeted by CIMMYT's breeding program.

plant breeding programs, and although scientific breeding methods may allow progress to be achieved more rapidly in breeders' plots than in farmers' fields, the gains made by farmers over thousands of years have been enormous.

In addition to failing to acknowledge that local varieties are also improved, use of the term *improved materials* to refer only to cultivars produced by formal breeding programs has another unfortunate consequence. Maize varieties and hybrids undergo a continual process of genetic change in farmers' fields. In the case of varieties and hybrids that were originally developed by formal breeding programs, this phenomenon is sometimes referred to as "genetic deterioration" or "genetic depreciation," with the process being described as one in which improved materials become "contaminated" by exposure to external sources of pollen. Use of such negative terms is misleading and may in fact incorrectly

characterize what is actually happening. Although genetic change is undesirable when farmers would prefer to preserve the characteristics of the original germplasm, in many instances genetic change occurs as cultivars become better adapted to local production conditions and/or consumption preferences. In other words, what some plant breeders refer to with the perjorative term "genetic deterioration" may in fact be a positive phenomenon from the point of view of farmers. Thus, the process is more appropriately described with less value-laden terms, for example, as the "rustification" or "local adaptation" of improved materials (Wood and Lenné 1997).

In this report, the term *improved materials* refers to the varieties and hybrids produced by formal plant breeding programs. This usage is not meant to imply that local varieties are in any sense unimproved.